

## Measuring the potential for water in soils... Tensiometer Probe

*The Tensiometer Probe measures soil moisture content in unsaturated soils. It is one of several probes at the INEEL inserted directly into contaminated wastes to monitor environmental conditions. The data it provides, combined with other probe data, can significantly influence environmental investigations and impact cleanup decisions.*



*The Tensiometer Probe obtains critical information to determine where and how contaminants migrate with soil moisture.*



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### **Why the need for this probe**

The INEEL Environmental Restoration Program needed to determine the direction and rate of soil water flow in the vadose zone, and to log these ground water data.

### **What the probe does**

The Tensiometer Probe measures matric potential—a measure of how tightly water is held under tension in an unsaturated environment.

Grouping tensiometers at different depths is a sure way to determine water gradients. It is the gradient in total water potential that controls the direction of water movement. Knowing this direction as a function of time is necessary to determine seasonal ground water infiltration.

### **Probe and operation description**

The Tensiometer Probe contains pressure sensors as a means to gather matric potential and soil pressure readings. The role of one sensor is to determine matric potential by means of water passing through a permeable or porous wall. In this case, water will be drawn out or pressed into the permeable section of the probe from the surrounding soil. The amount of pressure on the permeable reservoir is monitored and feedback is sent to a data logging system on the land surface. The resulting data are used to determine water front movements and gradients.

A second pressure sensor monitors the surrounding soil next to the permeable reservoir. This sensor monitors the local soil pressure and fluctuations in ground pressure. The pressure sensor is monitored and feedback is also sent to the data logging system.

Tensiometers require periodic maintenance consisting primarily of resupplying a small amount of water to the reservoir chambers, and re-zeroing pressure transducers. These functions can be completed from land surface without possible chemical or radiological contaminant migration.



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*Close up of the porous section of the Tensiometer Probe that allows moisture to be drawn into the probe's reservoir.*



The INEEL has modified the tensiometer design to incorporate a contamination seal system between the instrument reservoirs and the probe casing. The potential migration of contaminants and solvents to the land surface requires that a seal system be installed between the major components of the instrumented probe. The new design incorporates changes that separate the reservoirs from the probe casing.

When performing environmental surveillance, tensiometers are placed as close together as possible in the vertical horizons being studied. For example, they can be inserted at the overburden and waste interface, in the waste zone, and at the interface between the waste and underburden.

### Data results

The data log created by tensiometer readings indicate the moisture state within the waste zone and its variability—temporally and spatially, when networked with several tensiometers. It also quantifies the amount and timing of groundwater infiltration through the waste zone, and can determine the amount and lateral extent of perched water toward the bottom of the waste zone.

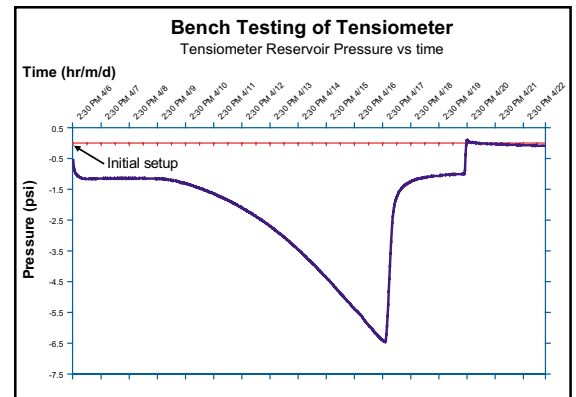


*Field technicians connect transfer and data transmission lines before installing the protective cap.*

### Benefits

Subsurface data obtained using the Tensiometer Probe includes these benefits:

- Quantifies water infiltration and potential movement of contaminants.
- Reduces uncertainty in risk assessment calculations that influence cleanup decisions.
- Avoids environmental harm by using minimum instrumentation and leaving it in place.
- Increases worker safety by reducing exposure and risk.
- Validates the accuracy of characterization data and process knowledge.



*Hourly plots of Tensiometer Probe readings indicate the fluctuations in soil moisture content.*

### Points of contact

To discuss how the Tensiometer Probe might apply to your needs, contact **Andy Baumer**, or one of the other references at the phone or e-mail address shown. The INEEL's *Technology Catalog* is another reference on new and innovative technologies. It's on the web at [tech.inel.gov](http://tech.inel.gov).

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